EEAP 210

EXTRA CREDIT PROJECTS

These will be due May 2, 1984

You may obtain up to ± 10% in the exam catagory.
Recall that; Exam 1 = 10%
Exam 2 = 20%
Exam 3 = 20%
Final = 30%

Extra credit points will be added in <u>after</u> your grade is determined on the basis of exams and homeworks. Note that scale is ± 10%. I will take off points if you did not make a serious effort, i.e. I will not accept a token effort as it represents my time to grade your project.

Note: 1. Additional references can be suggested. See Prof. Merat.
2. Group projects are not allowed.
3. For numerical projects any computer may be used. Computer time will be available on the Kerncomputer system which has PASCAL and Fortran-77. See Prof. Merat for details

<u>Project #1</u>

Numerically (on a computer) solve Laplace's Equation for a set of boundary conditions to be supplied. References: Skitek & Marshall, Section 7.3, Paul & Nasar, Section 10.6

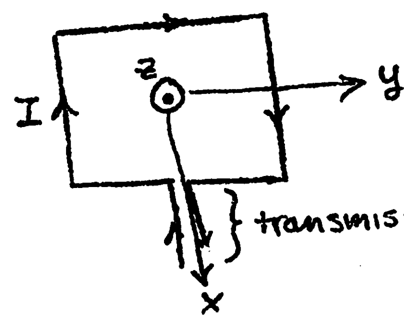
<u>Project #2</u>

Write a short manual describing the use of the Smith Chart for matching problems. Solve text book Problems 12.16 and 12.19 as examples for your manual.

Extra Credit Projects (Cont.)

Project #3

Antenna problems are usually solved by letting the antennas be modeled by equivalent surface currents and computing the resultant vector potential $\underline{A}$. For radiating waves $\underline{E}$ and $\underline{H}$ can be computed from $\underline{A}$. Find the farfield radiation pattern for the loop antenna shown below. Reference: Sections 14.3-14.4 of Skitek & Marshall. Each side is of length S.



Project #4

Use a computer to calculate the magnitude and phase of the total voltage on a lossy transmission line. Use the parameters given below, Plot your results

$$V_{INCIDENT} = V_0 e^{\alpha x} e^{j(\omega t + \beta x)}$$

$$V_{reflected} = -\frac{3}{4} V_0 e^{-\alpha x} e^{j(\omega t - \beta x)}$$

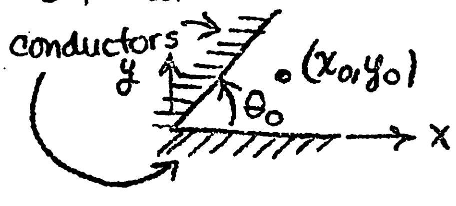
where $V_0 = 10$ volts, $f = 250\,\text{mHz}$ ($\lambda = 1.2$ meters), $\alpha = 0.2$ Nepers/meter.

Reference: Skitek & Marshall, Section 12.12.

Project #5

Laplace's equation can be solved by powerful mathematical techniques in certain situations. Solve the following problem by a combination of conformal mapping and the method of images.

A line charge of density q_ℓ coulombs/meter is located at (x_0, y_0) in the inside of a conducting wedge of angle θ_0. Use a transform of the form $w = z^{\alpha}$ or in polar form $Re^{j\phi} = r^{\alpha} e^{j\alpha\theta}$ to map the wedge into an infinite half-plane. Use the method of images to solve for the potential ϕ of the transformed problem. Finally, transform your solution back to the z-plane.



Reference: Plonsey & Collin, *Principles & Applications of Electromagnetic fields*, Sections 2.10, 4.4 and 4.5.

EXTRA CREDIT PROBLEM #1

APPROXIMATE SOLUTIONS